A 13.2: In8 109

FOREST CONTROL *by* CONTINUOUS INVENTORY

"Today I have grown taller from walking with the trees."
...Karle Wilson

Milwaukee, Wis. April, 1963 No. 109

THE FOREST IN THREE DIMENSIONS

Three dimensional pictures of Scribner and International log scale volume tables are given with this Newsletter. I believe every forester will be interested to see these graphic volume tables. They are pictures many of us should have had 20 - 40 years ago; or have I forgotten early lessons in the field of graphic representation? Perhaps we had them 20 to 40 years ago. In any event the graphs presented are not only useful, as in this case for the preparation of electronic data processing formulas for computing individual tree volumes, but they open up other intriguing vistas as well.

It is entirely possible, by EDP formula and with the aid of graphic pictures, to compare and correlate whole series of tabulations from sequential CFI control cases.

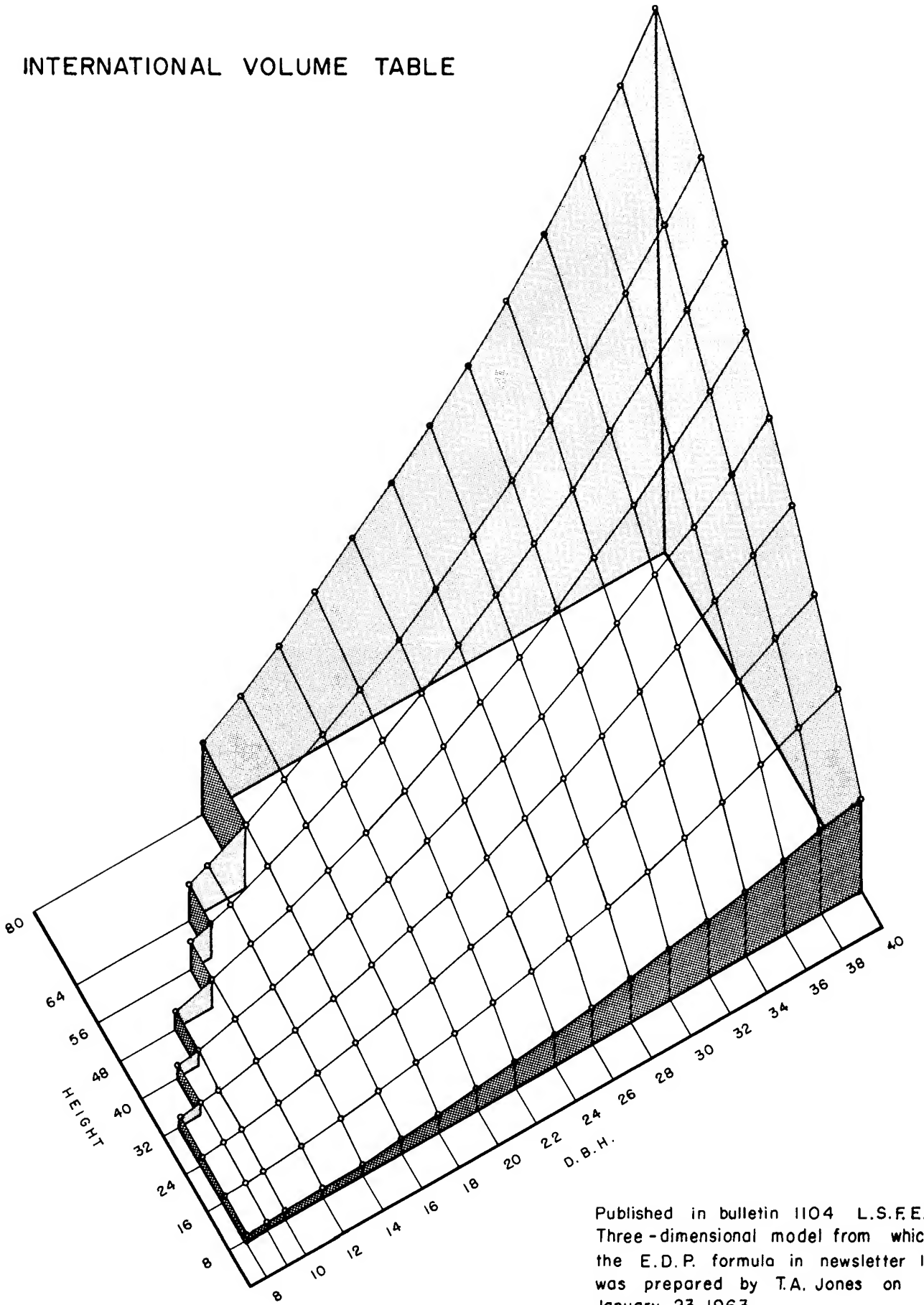
These formulas and figures, related to the normal situation where such information is available, can be developed to show the extent and direction of digression from normality in many combinations of biological data collected in the forest. In short, with EDP and permanent plot records, we may soon begin to micrometer the effects of our forest management methods. When we do this, not only in terms of volumes but of values as well, we may expect a great impetus in action programs for forest improvement.

FORESTRY SCHOOL LIBRARY
COPY NO.

CAL STOTT

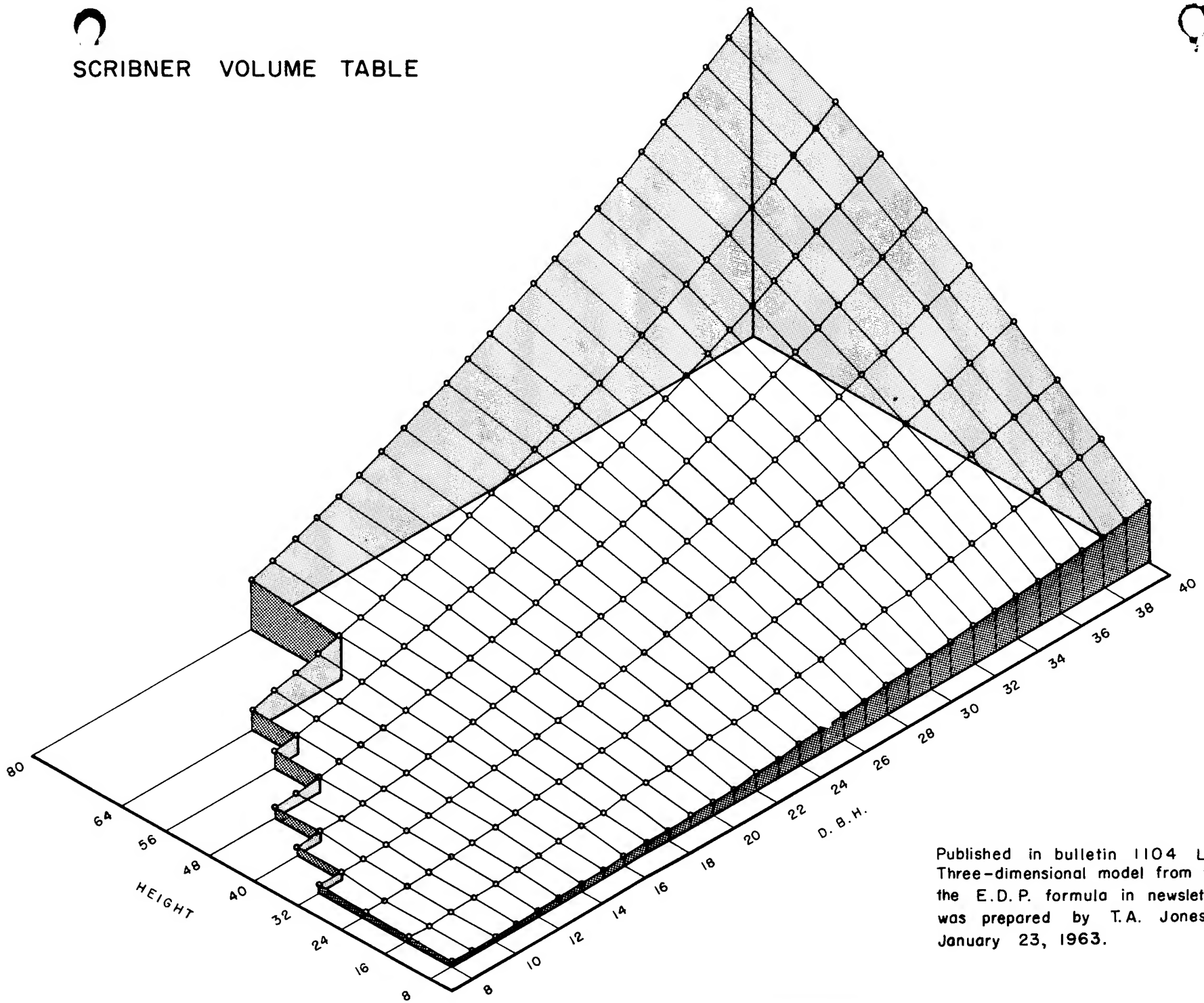
The Forester

INTERNATIONAL VOLUME TABLE



Published in bulletin 1104 L.S.F.E.S. Three-dimensional model from which the E.D.P. formula in newsletter 109 was prepared by T.A. Jones on January 23, 1963.

SCRIBNER VOLUME TABLE



Published in bulletin 1104 L.S.F.E.S. Three-dimensional model from which the E.D.P. formula in newsletter 98 was prepared by T.A. Jones on January 23, 1963.

USDA-SCS-MILWAUKEE, WIS. 1963

FORMULA FOR COMPUTING THE INTERNATIONAL VOLUME OF SAWLOG TREES

BASIS: Bulletin 1104. Composite Volume Tables for Timber and Their Application in the Lake States. S. R. Gevorkiantz and L. P. Olsen, Lake States Forest Experiment Station, Forest Service.

THE FORMULA

$$V_I = \left[a + \sum_{i=1}^{10} b_i x_i \right] (SP_f) (So_f)$$

IN WHICH

V_I = Volume International

a = Constant -0.092685

$\left\{ \sum_{i=1}^{10} b_i x_i \right\}$ = Algebraic sum of the products of 10 constants and 10 variables

b_i = The 10 constants

x_i = The 10 variables

SP_f = Species variation factor

So_f = Soundness factor

LIST OF THE 10 CONSTANTS AND 10 VARIABLES

b_i CONSTANTS	x_i VARIABLES	
a = - .092,685		
1. b_1 = -5.979,822	multiplied by V_c	(Volume of truncated cone)
2. b_2 = -2.971,515	multiplied by D	(DBH)
3. b_3 = +2.087,770	multiplied by H	(Usable Length)
4. b_4 = + .030,884,2	multiplied by D^2H	
5. b_5 = - .014,336,1	multiplied by H^2	
6. b_6 = - .008,757,15	multiplied by Vc^2	
7. b_7 = + .351,046	multiplied by D^2	
8. b_8 = + .000,070,460,8	multiplied by D^2H^2	
9. b_9 = - .000,000,589,521	multiplied by D^2H^3	
10. b_{10}= + .000,000,030,035,02	multiplied by D^4H^2	

DEVELOPMENT OF VOLUME OF TRUNCATED CONE (Vc)

$$Vc = H(.134463 + .375\,246\,R + 1.047198\,R^2)$$

IN WHICH

$$R = \left(.358333 + \frac{H\left(\frac{D}{24} - .358\,333\right)}{H - 3.5} \right)$$

THE FINAL FORMULA IN DETAIL

$$V = (a + b_1V_c + b_2D + b_3H + b_4D^2H + b_5H^2 + b_6V_c^2 + b_7D^2 + b_8D^2H^2 + b_9D^2H^3 + b_{10}D^4H^2)\,(SP_f)\,(So_f)$$

Note: See Newsletter No. 97 for Basal Area and DBH Class Formulas.

Thomas A. Jones
Central Planning Department
Kimberly-Clark Corporation, Neenah, Wis.

Newsletter No. 108, March, 1963, Forest Service, R-9

Board Foot Volumes Computed Using A Formula Derived From

Table 2 In Technical Bulletin 1104, L.S.F.E.S.

Thomas A. Jones
January 31, 1963

	INTERNATIONAL								
	1/2	1	1-1/2	2	2-1/2	3	3-1/2	4	5
DBH	8'	16'	24'	32'	40'	48'	56'	64'	80'
8	13	25	36	45					
10	21	38	54	68	79	89			
12	30	56	78	98	116	131	145		
14	43	78	107	135	160	184	204	222	
16	58	104	143	179	214	246	275	300	
18	75	135	184	231	276	317	356	391	446
20	95	170	232	290	346	399	448	493	567
22	116	209	284	356	425	490	551	607	702
24	141	253	343	429	511	590	664	733	850
26	167	301	407	508	606	700	788	870	1,011
28	196	352	476	595	709	818	922	1,018	1,185
30	227	409	551	687	819	945	1,065	1,177	1,372
32	259	468	631	787	937	1,081	1,219	1,347	1,570
34	294	533	717	892	1,062	1,226	1,382	1,527	1,781
36	330	600	807	1,004	1,195	1,379	1,554	1,717	2,003
38	368	671	903	1,122	1,335	1,540	1,734	1,917	2,236
40	408	747	1,003	1,246	1,482	1,708	1,924	2,127	2,480

Board Foot Deviations Of Formula Volumes From Table 2 In Technical Bulletin 1104, L.S.F.E.S.

Thomas A. Jones
January 31, 1963

	INTERNATIONAL								
	1/2	1	1-1/2	2	2-1/2	3	3-1/2	4	5
DBH	8'	16'	24'	32'	40'	48'	56'	64'	80'
8	- 2	1	1	- 1					
10	0	- 1	0	0	3	8			
12	0	- 1	- 2	- 2	2	7	15		
14	1	- 1	- 3	- 5	- 3	0	10	17	
16	- 1	- 1	- 4	- 1	1	- 1	1	5	
18	1	0	- 4	- 4	- 2	- 3	- 4	- 9	6
20	3	0	- 4	- 5	- 4	- 1	- 2	- 7	- 3
22	4	0	- 6	- 6	- 5	- 5	- 4	- 3	-13
24	8	1	- 3	- 1	1	- 5	- 6	- 7	-20
26	9	1	- 3	- 2	1	0	- 2	-10	- 9
28	9	4	- 4	0	9	8	2	- 2	- 5
30	7	- 1	1	2	9	15	5	- 3	12
32	5	- 2	- 4	- 3	7	11	9	- 3	20
34	3	3	- 8	- 8	2	16	2	- 3	21
36	- 3	0	-13	- 6	5	9	4	- 8	3
38	- 6	1	- 7	2	5	10	4	-13	- 4
40	- 7	2	- 7	- 4	2	8	- 6	-33	0

Per Cent Deviations of Formula Volumes From Table 2 In Technical Bulletin 1104, L.S.F.E.S.

Thomas A. Jones
January 31, 1963

	INTERNATIONAL								
	1/2	1	1-1/2	2	2-1/2	3	3-1/2	4	5
DBH	8'	16'	24'	32'	40'	48'	56'	64'	80'
8	-13.3	+ 4.2	+ 2.9	- 2.2					
10	0	- 2.6	0	0	+ 3.9	+ 9.9			
12	0	- 1.8	- 2.5	- 2.0	+ 1.8	+ 5.6	+11.5		
14	+ 2.4	- 1.3	- 2.7	- 3.6	- 1.8	0	+ 5.2	+ 8.3	
16	- 1.7	- 1.0	- 2.7	- .6	+ .5	- .4	+ .4	+ 1.7	
18	+ 1.4	0	- 2.1	- 1.7	- .7	- .9	- 1.1	- 2.3	+ 1.4
20	+ 3.3	0	- 1.7	- 1.7	- 1.1	- .2	- .4	- 1.4	- .5
22	+ 3.6	0	- 1.7	- 1.7	- 1.2	- 1.0	- .7	- .5	- 1.8
24	+ 6.0	+ .4	- .9	- .2	+ .2	- .8	- .7	- .9	- 2.3
26	+ 5.7	+ .3	- .7	- .4	+ .2	0	- .3	- 1.1	- .9
28	+ 4.8	+ 1.1	- .8	0	+ 1.3	+ 1.0	+ .2	- .1	- .4
30	+ 3.2	- .2	+ .2	+ .3	+ 1.1	+ 1.6	+ .5	- .3	+ .9
32	+ 2.0	- .4	- .6	- .4	+ .8	+ 1.0	+ .7	- .2	+ 1.3
34	+ 1.0	+ .6	- 1.1	- .9	+ .2	+ 1.3	+ .1	- .2	+ 1.2
36	- .9	0	- 1.6	- .6	+ .4	+ .7	+ .3	- .5	+ .2
38	- 1.6	+ .1	- .8	+ .2	+ .4	+ .7	+ .2	- .7	- .2
40	- 1.7	+ .3	- .7	- .3	+ .1	+ .5	- .3	- 1.5	0

Board Foot Volumes Computed Using The New International Formula Derived from Table 2 In Technical Bulletin 1104, L.S.F.E.S.

Thomas A. Jones
January 31, 1963

	INTERNATIONAL								
	1/2	1	1-1/2	2	2-1/2	3	3-1/2	4	5
DBH	8'	16'	24'	32'	40'	48'	56'	64'	80'
8	13.4	25.3	36.2	45.0					
10	20.7	38.4	53.9	67.6	79.4	89.2			
12	30.4	55.6	77.8	97.7	115.6	131.4	144.7		
14	42.8	77.8	107.3	134.9	160.5	183.7	204.3	221.5	
16	57.7	104.1	142.8	179.5	213.9	245.7	274.7	299.9	
18	74.8	134.5	184.5	231.4	275.8	317.5	355.9	390.8	446.2
20	94.5	169.8	231.5	290.1	346.0	399.0	448.2	493.1	567.2
22	116.5	209.0	284.5	356.0	424.6	489.8	550.9	607.5	701.9
24	140.9	252.9	342.7	428.6	511.3	590.2	664.5	733.0	850.0
26	167.4	300.7	406.7	508.2	606.0	699.6	788.1	870.0	1011.2
28	195.9	352.4	476.5	594.5	708.6	818.0	921.6	1018.5	1185.1
30	226.6	408.5	551.2	687.4	818.9	945.4	1065.3	1177.4	1371.7
32	259.2	468.4	631.5	786.7	936.9	1081.3	1218.5	1347.2	1570.4
34	293.9	532.5	716.6	892.3	1062.3	1225.9	1381.6	1526.9	1780.9
36	330.2	600.2	807.0	1004.2	1195.0	1378.7	1553.6	1717.1	2002.9
38	368.0	671.4	902.6	1122.3	1334.9	1539.6	1734.4	1917.3	2236.1
40	407.6	746.6	1002.7	1246.2	1481.7	1708.5	1924.3	2126.6	2480.0

VOLUMES PER TREE COMPUTED FOR CHECKING RANDOM EDP RESULTS

DBH	U.L. Logs	Gross Volume		Sp_f	Half adjust.		So_f	Net Bd. Ft. Volume	Half adjust.
8.0	1/2	13.4	x	1.00	xx.o	x	0.97	13.0	xx.o
16.0	1-1/2	142.8	x	1.08	xxx.o	x	0.86	132.6	xxx.o
16.0	3	245.7	x	1.05	xxx.o	x	0.78	201.2	xxx.o
22.0	5	701.9	x	1.00	xxx.o	x	1.00	701.9	xxx.o
24.0	2-1/2	511.3	x	0.98	xxx.o	x	0.65	325.7	xxx.o
32.0	1-1/2	631.5	x	0.96	xxx.o	x	0.93	563.8	xxx.o
32.0	3-1/2	1218.5	x	1.08	xxxx.o	x	0.97	1276.5	xxxx.o
40.0	2-1/2	1481.7	x	1.15	xxxx.o	x	0.86	1465.4	xxxx.o